CLAIMS

What is claimed is:

1. A phase-locked loop (PLL) for producing a phase-locked oscillation, the PLL comprising:

a phase detection module for producing a current representing a phase difference between a feedback signal and a reference signal;

a loop filter operably coupled to receive the current and for converting the current into a control voltage; and

a voltage controlled oscillator (VCO) operably coupled to receive the control voltage at a VCO input and to produce an oscillation signal responsive to the control voltage wherein the oscillation signal is provided to the phase detection module in a first feedback loop, wherein:

the VCO further comprises a phase adjustment module for reducing phase noise in the oscillation signal, the phase adjustment module operably coupled to receive the oscillation signal and to produce a correction voltage to counteract a phase shift resulting from phase noise in the oscillation signal; and

wherein the correction voltage is provided to adjust the oscillation signal frequency in a second feedback loop.

2. The PLL of claim 1 wherein the phase adjustment module further includes a plurality of sampling modules coupled to receive the oscillation signal, wherein each sampling module of the plurality of sampling modules samples the oscillation signal over a different time interval to produce a sampled voltage corresponding to a change in the period of the oscillation signal.

3. The PLL of claim 2 further including a variable low pass filter coupled to receive the sampled voltage from the

plurality of sampling modules, wherein the variable low pass filter produces a filtered voltage representing a running average of the received sampled voltage.

4. The PLL of claim 3 further including a plurality of operational amplifiers, each operational amplifier coupled to receive, at a first input, the sampled voltage produced from each sampling module of the plurality of sampling modules, and coupled to receive the filtered voltage at a second input, and wherein each operational amplifier produces an output signal representing a difference between the received sampled voltage and the received filtered voltage.

5. The PLL of claim 4 wherein each operational amplifier is configured as a transconductance amplifier wherein the output signal is a current signal.

6. The PLL of claim 4 wherein each operational amplifier is configured as a voltage amplifier wherein the output signal is a voltage signal.

7. The PLL of claim 4 further including a summing module operably coupled to receive the output signals from each operational amplifier of the plurality of operational amplifiers and to produce therefrom the correction voltage.

8. The PLL of claim 7 further including a phase logic module for controlling operational characteristics of the phase adjustment module.

9. The PLL of claim 8 wherein the sampling module of the plurality of sampling modules further includes a sampling logic module operably coupled to receive the oscillation signal and operably coupled to receive at least one control signal from the phase logic module.

10. The PLL of claim 9 further including a variable current source serially coupled to a switch which is serially coupled to a capacitor, the variable current source for charging the capacitor during a specified time interval.

11. The PLL of claim 10 further including a sampling amplifier coupled to receive a capacitor voltage and to produce a sampled voltage corresponding to the period of the oscillation signal during the specified time interval.

12. The PLL of claim 11 wherein the sampling amplifier includes one of a fixed gain and a variable gain.

13. The PLL of claim 11 wherein the capacitor comprises a variable capacitor.

14. A VCO, comprising:

oscillation circuitry operably coupled to receive a control voltage at a VCO input and to produce an oscillation signal responsive to the control voltage;

a phase adjustment module for reducing phase noise in the oscillation signal, the phase adjustment module operably coupled to receive the oscillation signal and to produce a correction voltage to counteract a phase shift resulting from phase noise in the oscillation signal; and

wherein the correction voltage is provided to adjust the oscillation signal frequency.

15. The VCO of claim 14 wherein the phase adjustment module further includes a plurality of sampling modules coupled to receive the oscillation signal, wherein each sampling module of the plurality of sampling modules samples the oscillation signal over a different time interval to produce a sampled voltage corresponding to a change in the period of the oscillation signal.

16. The VCO of claim 15 further including a variable low pass filter coupled to receive the sampled voltage from the plurality of sampling modules, wherein the variable low pass filter produces a filtered voltage representing a running average of the received sampled voltage.

17. The VCO of claim 16 further including a plurality of operational amplifiers, each operational amplifier coupled to receive, at a first input, the sampled voltage produced from each sampling module of the plurality of sampling modules, and coupled to receive the filtered voltage at a second input, and wherein each operational amplifier produces an output signal representing a difference between the received sampled voltage and the received filtered voltage.

18. The VCO of claim 17 wherein each operational amplifier is configured as a transconductance amplifier wherein the output signal is a current signal.

19. The VCO of claim 17 wherein each operational amplifier is configured as a voltage amplifier wherein the output signal is a voltage signal.

20. The VCO of claim 17 further including a summing module operably coupled to receive the output signals from each operational amplifier of the plurality of operational amplifiers and to produce therefrom the correction voltage.

21. The VCO of claim 20 further including a phase logic module for controlling operational characteristics of the phase adjustment module.

22. The VCO of claim 21 wherein the sampling module of the plurality of sampling modules further includes a sampling logic module operably coupled to receive the oscillation

signal and operably coupled to receive at least one control signal from the phase logic module.

23. The VCO of claim 22 further including a variable current source serially coupled to a switch which is serially coupled to a capacitor, the variable current source for charging the capacitor during a specified time interval.

24. The VCO of claim 23 further including a sampling amplifier coupled to receive a capacitor voltage and to produce a sampled voltage corresponding to the period of the oscillation signal during the specified time interval.

25. The VCO of claim 24 wherein the sampling amplifier includes one of a fixed gain and a variable gain.

26. The VCO of claim 23 wherein the capacitor comprises a variable capacitor.

27. A method for producing an oscillation, comprising:

receiving a control voltage and producing an oscillation signal responsive to the control voltage;

reducing phase noise in the oscillation signal by producing a correction voltage to counteract a phase shift resulting from phase noise in the oscillation signal; and

producing the correction voltage to adjust the oscillation signal.

28. The method of claim 27 further including sampling the oscillation signal over a plurality of different time intervals to produce a sampled voltage corresponding to a change in the period of the oscillation signal.

29. The method of claim 28 further including filtering the sampled voltage from the plurality of sampling modules and

producing a filtered voltage representing a running average of the received sampled voltage.

30. The method of claim 29 further including producing a correction voltage representing a difference between the sampled voltage and the filtered voltage.